

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
FERTILIZER RESEARCH AND EDUCATION PROGRAM (FREP)

2004-2006 Final Report

Project Title:

Improving the Procedure for Nutrient Sampling in Stone Fruit Trees

Contract: #03-0652

Project Leader:

R. Scott Johnson

U.C. Kearney Agricultural Center

Cooperators:

Harry L. Andris

UCCE Fresno County

Robert H. Beede

UCCE Kings County

Kevin R. Day

UCCE Tulare County

Nat B. Dellavalle

Dellavalle Laboratory

Introduction

Mid summer is the recommended period of sampling leaves for nutrient analysis in fruit trees. This practice was first developed in the 1940s and was widely applied to orchards during the 1950s. In 1971 Leece compiled a list of 39 peach studies from seven countries and concluded, "with few exceptions, good agreement existed amongst the studies for any particular nutrient". Thus, the practice became very widespread and is the standard to this date. The timing of about 100 to 140 days after bloom has been established because the concentration of most nutrients remains fairly stable during this time. This corresponds to the period from early June through late July in the central valleys of California.

We see at least two problems with this timing, especially in light of our modern era of environmental concerns and an emphasis on good sustainable fertilization practices. First, the timing of mid summer for sampling does not fit well into a sustainable fertilizer program since many fertility decisions need to be made early in the spring. Growers are generally most interested in fertility management as they watch their trees flower, leaf out and set a crop in the spring. By summer their interest has waned. Second, this timing also does not make sense from a tree physiological perspective. Many critical processes such as flowering, fruit set, initial fruit growth, and

shoot growth are all happening in the early spring and should be dependent on tree nutrient status at that time. A dormant or early spring sample should give a good indication of stored nutrients and whether any are limiting.

This study will evaluate the nutritional status of several different plant parts in hopes of finding a reliable and consistent sampling procedure to help guide fertilization practices in the spring.

Statement of Objectives:

1. To test the feasibility of measuring boron, zinc and nitrogen (and other nutrients if possible) in stone fruit trees during the dormant season or early spring and relate those nutrient levels to the various components of yield and fruit quality.
2. To develop deficiency threshold values for these nutrients that can be used to guide fertilization decisions early in the season.
3. To test the usefulness of these threshold values in commercial orchards.

Executive Summary:

Using Zee Lady peach and Grand Pearl nectarine trees planted in 60 large sand tanks and by surveying over 60 commercial orchards in the San Joaquin Valley, we have been investigating the possibility of using dormant shoots to determine the nutritional status of peach and nectarine trees. Although we have not succeeded with every nutrient, we have made good progress and will continue our efforts even though this FREP project is over. The sand tanks were installed in 2000 and 15 different fertilizer treatments were imposed beginning in 2001. By 2004, there were clear signs of N, P, B and Zn deficiencies in individual trees. Shoot samples were taken from the trees in January of 2003, 2004, 2005 and 2006. In 2004 we proposed deficiency thresholds for these four nutrients. In 2005 we tested these values in over 60 commercial orchards. After some refinement in 2006, our conclusions are as follows:

Nitrogen. Total nitrogen in dormant shoots is not a good indicator of tree N status. We are working to develop a test using arginine and/or other amino acids.

Phosphorus. P deficiency is rare in California peach orchards but a threshold of 0.12% P in dormant shoots should be a reliable guide to identifying the deficiency.

Boron. B deficiency is also rare in California orchards but the proposed threshold of 14 ppm could be used as a valuable tool in identifying orchards where B applications might be helpful.

Manganese. Minor leaf symptoms are observed when dormant shoot Mn levels drop below 8 or 9 ppm. However, treatment with Mn fertilizers is probably not necessary until the level drops even lower.

Zinc. We are still in the process of refining a sampling procedure for Zn. At this point we anticipate collecting shoots from the lower part of the tree in fall or early winter and have tentatively set the threshold at 15 ppm.

Potassium, Magnesium and Calcium. We hope to have trees deficient in these 3 elements within a year or two so deficiency thresholds can then be established.